Raman spectroscopy and autofluorescence analysis with patient’s demographics for skin cancer detection

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Materials and methods

Patients: 157 malignant neoplasms (49 melanomas (MM), 108 basal cell carcinomas (BCC)); 324 benign neoplasms (NN pigmented nevus (PN), 90 seborrheic keratosis (SK)). At the initial appointment physician collected demographics for all patients: gender (G), age (A), location (L), genetics (G), Diseases (D), Burns (B), Size (S), occupational hazards (H).

Data preprocessing: • smoothing by Savitsky-Golay method, • standard normal variation, • centering.

PLS-DA analysis was used to build regression models to classify different skin neoplasms. In regression model each tumor was described by the Raman and autofluorescence spectral data incorporating with demographics. The stability of the PLS-DA models was checked by means of 10-fold cross-validation. Multivariate analysis was carried out with using the MDAtools package in R studio.

Conclusions

In summary, skin cancer diagnosis by joint Raman and autofluorescence spectroscopy was investigated by incorporating patient demographics. Diagnosis according to gender (G), age (A), location (L), genetics (G), Diseases (D), Burns (B), Size (S), occupational hazards (H) showed varying effects on diagnostic performance, and not all differences were statistically significant (P>0.05).

When patient demographic information was incorporated into the model for Raman spectral analysis, the AUC under the ROC curve was improved from 0.610 to 0.789 (P < 0.05; PLS) for classification of malignant versus benign neoplasms, from 0.789 to 0.849 (P < 0.05; PLS) for classification of melanoma versus benign pigmented neoplasms (nevus and seborrheic keratosis). Improving of the AUC under the ROC curve from 0.814 to 0.820 (P < 0.05; PLS) for classification of melanoma versus seborrheic keratosis was statistically insignificant (P > 0.05).